

THE IMMATURE STAGES OF *TIPULA SIMPLEX* DOANE
AND *T. ACUTA* DOANE (DIPTERA: TIPULIDAE)

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Records show that there are several species of crane flies capable of destroying valued rangeland in California. Of these, *Tipula simplex* Doane, the range crane fly, is apparently the most devastating. Although outbreaks have been reported in several counties, Tulare, Tehama and Marin counties have sustained the heaviest infestations and damage. Marin County reported heavy infestations in 1927, 1956, and 1961. In 1961, 12,000 hectares were involved and at one location, records show infestations as great as 4300 larvae per square meter (Marin County Ag. Comm., pers. comm.). Tulare County reported outbreaks in 1961, 1967, and in the winter of 1972-1973 (Tulare County Ag. Comm., pers. comm.). According to the latest survey, during the winter of 1973-1974, *Tipula simplex* has, in Tulare County alone, affected in excess of 13,000 hectares of pasture with density in some samples as great as 3000 larvae per square meter. In the more acute infestations the hills are denuded of all grass and other important forage, which makes the ranchers understandably concerned. The production of cattle is reduced two-thirds or more during such infestations. The adverse effect on the watershed must also be considered as there are no roots to hold the soil together. The top layer is simply washed away, leaving a characteristic slick. It takes some years for the grasses to re-establish themselves on such hill-sides and even longer to reach their normal cattle carrying capacity (Hartman and Hynes, 1977). In the winter of 1978, Tehama County reported crane fly damage for the first time.

Tipula simplex, however, is not the only crane fly living in grasslands. Reports from the literature indicate *Tipula quaylii* Doane and *T. graminivora* Alexander also are involved in range destruction (Alexander, 1921; Packard and Thompson, 1921). *Tipula simplex* appears to live in sympatry with crane fly species that do no detectable damage. We have found *T. silvestra* Doane in Marin County and *T. acuta* Doane in Tulare County as-

sociated with *T. simplex*. Several other species belonging to the subgenus *Triplicitipula* may be involved. The relative importance of species other than *T. simplex* in rangeland destruction has not been ascertained but appears to be minimal.

At present, there is no paper available which contains descriptions of the immature stages or gives a key to their identification. Agricultural workers have no way of recognizing the different immature stages of the species. This paper is primarily aimed at giving such workers descriptions for field identifications of the larvae and pupae of *Tipula simplex* and *Tipula acuta*.

Alexander (1920), Hennig (1948), and Chiswell (1956) have given general accounts of the taxonomic characters which have been useful in describing larvae of the Tipulini.

Measurements of most larval structures give some idea of size but are not critical in differentiating between the larvae. The critical measurement separating various instars is the dextro-sinistral width at the base of the mandibles. The measurement given in the larval descriptions represents the extremes of dozens of specimens measured over several years. The ranges given hold true regardless of year or weather conditions. This information is given for instars of *T. simplex*, but is presently unavailable for all instars of *T. acuta*. By far the most useful characters in separating the species are those of the spiracular disc, as described below.

Description of Immature Stages

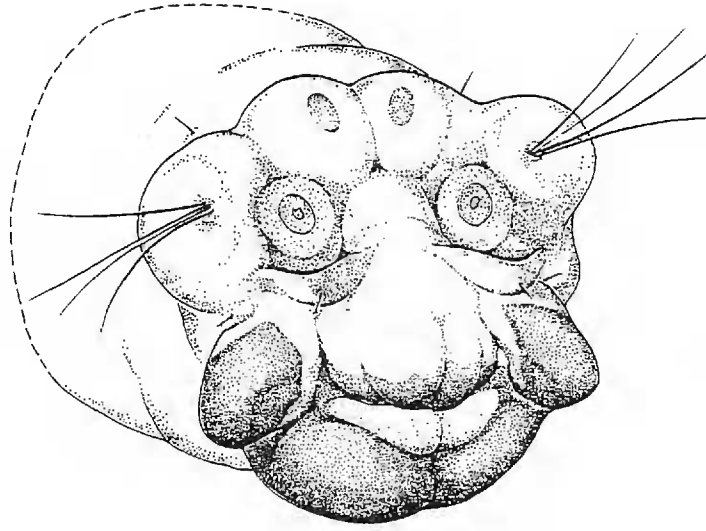
Tipula simplex

First instar larva.—Length, 3.1–4.0 mm; dextro-sinistral and dorsal-ventral width, 0.4–0.6 mm. Head capsule width at mandibles, 0.2 mm. Egg tooth on frons heavily sclerotized. Integument whitish; setal pencils black, one pencil on lateral margins of terga and sterna of each segment from prothorax through abdominal segment seven. Surface of larva covered sparsely with very short brown setae giving larva a dirty white color. Spiracular disc with four elongate setae coming off the lateral lobes. Markings of spiracular disc as in Fig. 1. Anal lobes much darker brown than remainder of body.

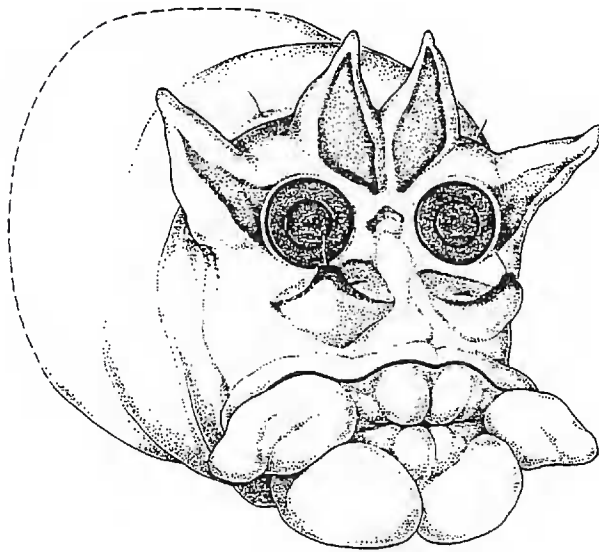
Last instar larva.—Length, 23.0–29.0 mm; dorso-ventral and dextro-sinistral width similar, 3.71–4.71 mm.

Head capsule.—Length, 1.9–2.34 mm (4th instar); dorso-ventral width at base of mandibles, 0.68–0.86 mm; dextro-sinistral width at base of mandibles, 0.860–1.189 mm (4th instar), 0.582–0.784 mm (3rd instar), not available (2nd instar), 0.202–0.253 mm (1st instar).

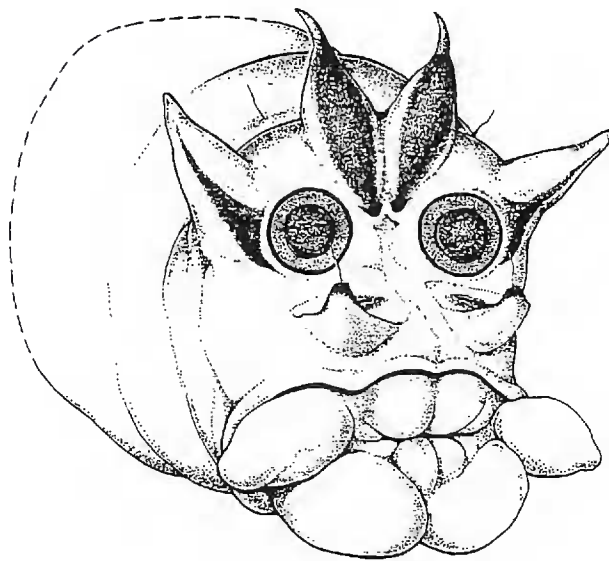
Cuticle unpigmented; tergal and sternal microsetae subequal, plural microsetae much shorter. Microsetae of thoracic segments forming continuous brown band around segment, anterior portion of band darker; pattern mottled, especially at junction of pleuron with tergum and sternum. Abdominal



1



2



3

Figs. 1-3. Figs. 1, 2. Caudal view of *Tipula simplex*. Fig. 1. First instar larva. Fig. 2. Fourth instar larva. Fig. 3. Caudal view of *Tipula acuta*, fourth instar larva.

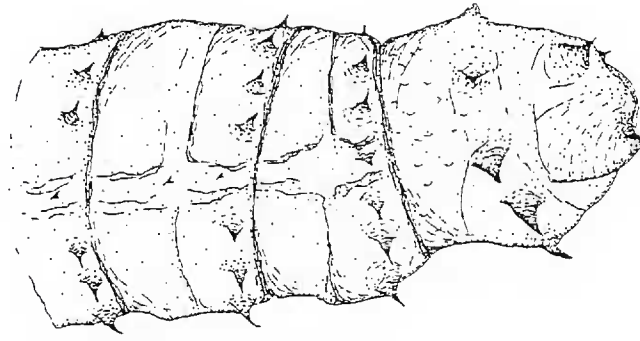
segments 1–7 with tergum light brown, dark tufts of microsetae at bases of macrosetae; sternum with anterior dark brown bands of microsetae, pattern mottled.

Spiracular disc with fleshy, conical, subequal dorsal and lateral lobes. Ventral lobes short, heavily sclerotized at blunt tip, directed dorsad. Spiracles dark brown, face of disc patterned with brown sclerotized areas as in Fig. 2. Anal lobes separated from remainder of abdomen by dark brown band of cuticle; lateral pair conical, directed laterad; remainder of lobes bulbous.

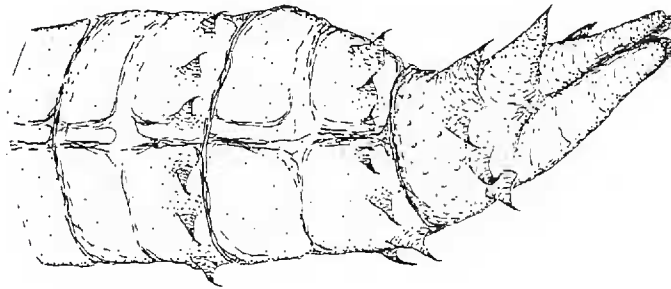
Pupa.—Length, 12.1 mm; dorso-ventral and dextro-sinistral width at base of wing pad, 2.5 mm. Body reddish brown; base of antennal sheaths armed with small spinous tubercle directed basad; breathing horns annulated, tip spatulate, light yellow, becoming abruptly dark brown at base of horn. Pronotal median carina dark brown; mesonotum with midline dark brown, face of dorsal crest rugose, one lateral and one medial tubercle on each side of midline, heavily patterned with dark brown at lateral edges. A tubercle also located on either side of midline at one-quarter distance between dorsal crest and posterior margin. Wing pads light brown with wing veins lighter, ending at anterior margin of second abdominal segment. Leg sheaths of male ending midlength of third abdominal segment; outer sheaths longest, medial sheaths and inner sheaths progressively shorter. Leg sheaths of female ending midlength of second abdominal segment; outer and medial sheaths subequal, inner sheaths shorter. Abdominal segments 2–7 reddish brown, each segment divided into 2 rings; pleural region carinate, yellow, speckled with dark brown spots. Anterior ring with forward area patterned with dark brown; posterior ring armed with transverse row of spines. Posterior ring patterned medially and laterally. Male and female cauda as shown in Figs. 4 and 5 respectively.

Tipula acuta

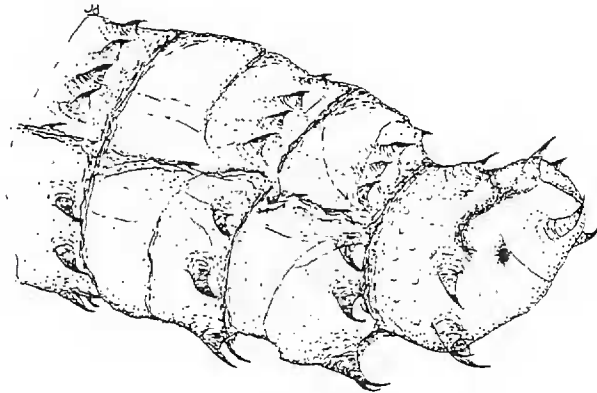
Last instar larva.—Length, 29.5–37.0 mm; dorso-ventral and dextro-sinistral width, 4.0–5.5 mm. Cuticle unpigmented, covered with dense, very short microsetae; dorsal and ventral microsetae subequal in length, pleural shorter. Microsetae of thoracic segments and first abdominal segment forming continuous bands around segment, with slightly mottled pattern at junctions of pleural area with tergum and sternum. Abdominal segments 3–7 with setae of tergum forming 4 dark brown stripes, posterior darker, wider, and mottled; setae of sternum patterned in 3 dark brown stripes, posterior wider. Pleural junctions with sternum and tergum mottled. Spiracular disc with six fleshy lobes, dorsal pair separate, elongate, sclerotized from base to hardened sharp point, ventral pair short; entire face of disc patterned as shown in Fig. 3. Anal field separated from remainder of abdomen by a dark brown band of cuticle; lateral lobes conical, remaining lobes bulbous.



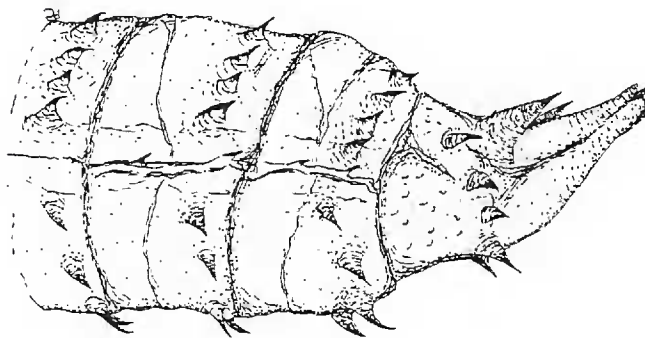
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5



6



7

Figs. 4-7. Figs. 4, 5. Lateral view of cauda of pupa of *Tipula simplex*. Fig. 4. Male. Fig. 5. Female. Figs. 6, 7. Lateral view of cauda of pupa of *Tipula acuta*. Fig. 6. Male. Fig. 7. Female.

Pupa.—Length, 19.7–24.0 mm; dorso-ventral and dextro-sinistral width, 3.5–3.9 mm. Body brown. Pronotal breathing horns brown, darker distally, annulated, spatulate at tips, directed laterad. Mesonotum with anterior surface rugose, dorsal crest with pair of spinous tubercles dorsally and a pair laterally. Wing pads dark brown, ending at posterior margin of second abdominal segment; veins not lighter. Leg sheaths dark brown, those of male ending midlength of third abdominal segment, those of female ending at posterior margin of second abdominal segment. Both sexes with outer and medial leg sheaths subequal; inner sheath slightly shorter. Abdominal segments 2–7 divided into 2 rings, with dorsal surface brown, darker ventrally; each ring abruptly lighter along posterior margins. Posterior ring armed with transverse row of spines. Lateral edge of each segment carinate, light in color, speckled with dark brown spots. Male and female cauda as shown in Figs. 6 and 7.

Key to Larvae of Crane Flies Living in Grasslands in Tulare County

1. Dorsal and lateral lobes of spiracular disc fleshy, conical, and subequal *T. simplex*
 Dorsal lobes of spiracular disc sclerotized from base to hardened sharp point, longer than lateral lobes *T. acuta*

Key to Pupae of Crane Flies Living in Grasslands in Tulare County

1. Wing pads ending at anterior margin of second abdominal segment; outer leg sheaths longest, medial and inner sheaths progressively shorter *T. simplex*
 Wing pads ending at posterior margin of second abdominal segment; outer and medial leg sheaths subequal *T. acuta*

Acknowledgments

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Literature Cited

- Alexander, C. P. 1920. The crane-flies of New York. Part II. Biology and phylogeny. Cornell Univ. Agric. Exp. Stn. Mem., 38:695–1133.
- Alexander, C. P. 1921. A new species of *Tipula* injurious to pasture lands (Tipulidae, Diptera). Insector Inscitiae Menstruus, 9:135–137.
- Chiswell, J. R. 1956. A taxonomic account of the last instar larvae of some British Tipulinae (Diptera: Tipulidae). Trans. R. Entomol. Soc. Lond., 108:409–484.
- Hartman, M. J., and C. D. Hynes. 1977. Biology of the range crane fly, *Tipula simplex* Doane (Diptera: Tipulidae). Pan-Pac. Entomol., 53:118–123.
- Hennig, W. 1948–1952. Die Larvenformen der Dipteren. Akademie-Verlag, Berlin, 1:1–185; 2: i–vii, 1–458; 3:i–vii, 1–628.
- Packard, C. M., and B. G. Thompson. 1921. The range crane-flies in California. U.S. Dep. Agric. Dep. Circ., 172:1–8.